REQUIRED TRAINING AND A TEAM CONCEPT BUILDING A BETTER HAZARDOUS MATERIALS PROGRAM FOR THE OMAHA FIRE DEPARTMENT

EXECUTIVE DEVELOPMENT

BY: Mark A Rohlfing
Battalion Chief
Omaha Fire Department
Omaha, Nebraska

An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

February 2000

ABSTRACT

This research project looked at the Omaha Fire Department's Hazardous Materials Response Team. Both action research and descriptive research were used to study the Omaha Fire Department's lack of training requirements and lack of strategy to build team unity. The purpose of this project was to develop training requirements for hazardous materials technicians and research strategies to help the team develop unity and excellence.

Four questions were answered to satisfy the goals of this project:

1. What are acceptable training standards for a fire department hazardous materials response team member at a technician level?
2. What can be done to mandate training requirements for the Omaha Fire Department's Hazardous Material Technicians?
3. What strategies can be employed to build team unity and excellence?
4. Can the organizational culture of the Omaha Fire Department be changed to accept the Hazardous Materials Team as an elite unit?

The procedures used in this project were a literature review, which included a review of the Omaha Fire Department's Standard Operating Procedures, General Orders, and budget information.

The results showed that training requirements for fire department hazardous materials response teams are mandated by law under the Occupational Safety and Health Administration's (OSHA) Code of Federal Regulations (CFR) 1910.120 and in the form of suggested standards, specifically, National Fire Protection Association (NFPA) 472. Although the Omaha Fire Department accepts OSHA CFR 1910.120 in

theory, both OSHA CFR 1910.120 and NFPA 472 need to be adopted as Standard Operating Procedures. The Department has shown a previous commitment to the program and now should extend that commitment to the training needs of their hazardous materials responders. The department should employ a team-building strategy along with a new emphasis on training to build an excellent hazardous materials program.

Recommendations resulting from this project were:

1. Adopt training standards based on the OSHA CFR 1910.120 and NFPA 471 and 472.
2. Develop an in-house Hazardous Materials Technician Program.
3. Develop selection criteria for which to select new hazardous materials team members.
4. Adopt a credible team-building and leadership program.
5. Re-write department Standard Operating Procedures.
6. Have a department-wide review and training on organizational culture.
7. Dedicate more financial support to hazardous materials training.

TABLE OF CONTENTS

PAGE

INTRODUCTION

The Omaha Fire Department provides a full range of fire and rescue services (fire suppression, advanced life support treatment and transport, fire prevention, fire investigation, fire inspections, special operations including confined space and high-angle rescue) including hazardous materials response. The city encompasses approximately 102 square miles with a population of approximately 400,000 people. The Omaha metropolitan area is approximately 900,000 people. Omaha is home to both heavy and light industry. It is the crossroads for two major interstate highways and two major railroads; in addition, it has a large navigable waterway. The likelihood of hazardous materials emergencies occurring in the Omaha metro area is very high.

Problem Statement: The Omaha Fire Department's Hazardous Materials Program does not have training standards for Hazardous Materials Technicians or a program to promote team unity and excellence.

Purpose Statement: The purpose of this research project is to develop training requirements for the Omaha Fire Department Hazardous Materials Technicians and to develop strategies to build unity and excellence on the team.

To satisfy this purpose, it is the goal of this research project to answer the following questions:

1. What are acceptable training standards for fire department Hazardous Materials Response Team members at a Technician level?
2. What can be done to mandate training requirements for the Omaha Fire Department's Hazardous Materials Technicians?

3. What strategies can be employed to build unity and team excellence on the Omaha Fire Department's Hazardous Materials Response Team?
4. Can the organizational culture of the Omaha Fire Department be changed to accept the Hazardous Materials Team as an elite unit?

Answering these questions will help the Omaha Fire Department to develop a better Hazardous Materials Unit. This Unit could serve as a model for the department as it updates and changes its training requirements.

BACKGROUND AND SIGNIFICANCE

Omaha, Nebraska, is a large mid-western city that has undergone substantial growth in the last twenty years. The Omaha Fire Department is a 600-person department comprised of three suppression shifts and nine support bureaus. The city is divided into six Battalions. The department's six battalions include 23 fire stations which are composed of: 22 engine companies, 10 aerial companies, 10 medical units, 1 heavy rescue/air truck, and a dedicated Hazardous Materials Unit. All fire suppression companies are staffed with a complement of four persons (one captain, one fire apparatus engineer, and two firefighters). The medical units are all staffed with two paramedics, a paramedic captain and a paramedic driver. A battalion chief manages each battalion. The Hazardous Materials Unit is staffed with four people, comprised of one captain, one fire apparatus engineer, and two firefighters. All members of the Hazardous Materials Team are Technician Trained Responders. Engine #33 is also staffed by four Hazardous Materials Technicians and is housed in the same location as the Hazardous Materials Unit.

In 1979, the Omaha Fire Department began to develop plans for a Hazardous Materials Response Unit. This was in response to developments across the country dealing with the mitigation of hazardous materials emergencies by fire department personnel. The industrial base in Omaha warranted a Hazardous Materials Response Team. The Omaha Fire Department decided to create the team. Omaha is a transportation hub, with two interstate highways (I-80 runs through the center of the city, and I-29 runs along the east edge of the city). Two railroad main lines run through the heart of the city, the Union Pacific Railroad and the Burlington Northern Railroad. On the east edge of the city is the Missouri River, a major navigable river.

By 1985, the Omaha Fire Department had completed an Emergency Response Plan and acquired a response vehicle with specialized hazardous materials response equipment. In June of 1985, the Omaha Fire Department placed the unit in service as "Haz-Mat 1" in an industrial area of town at Fire Station #30. The Hazardous Materials vehicle was a surplus Air Force van which was a 1973 Chevrolet step van that was refurbished by the Omaha Fire Department Shop. Personnel assigned to Engine #30 received additional training and took on the collateral duties of hazardous materials response as well as their regular fire suppression and emergency medical service calls.

The Hazardous Materials Response Unit was updated in 1990 with an International Box Truck, Model 1600, at a cost of $35,000.00. In the program's first ten years, the financial support for the Hazardous Materials Unit depended on the fire department's budget and how well the Hazardous Materials Team members could muster support from fire administration.

In 1995, the Hazardous Materials program took a large step forward and became a full-time, dedicated response team. The Hazardous Materials Team also expanded its responsibilities by adding: confined space rescue, high-angle rescue, and Rapid Intervention Team duties. In 1998, the City purchased a new state-of-the-art Hazardous Materials Unit custom-made by "E-One" at a cost of $380,000.00. Today our Hazardous Material Response Unit is one of the best-equipped hazardous materials response units in the country; however, the crews assigned to this Unit suffer from poor morale and are inadequately trained. The team also does not enjoy the confidence of the rest of the Omaha Fire Department. The Hazardous Materials Unit is looked upon as a bad and dangerous assignment because of the lack of training and qualified leaders in the program.

The Omaha Fire Department Hazardous Materials Program began its existence as a poorly funded program with little or no funding for education or training. Unfortunately, that pattern continues today. Training for the Omaha Fire Department Hazardous Materials Unit started with a core group of eight people who were sent to Texas A&M University Fire School for basic awareness, operations, and a Hazardous Materials Technician Program. Upon their return, the Unit became a fully functional response unit with team members handling all hazardous materials emergencies using both defensive and offensive tactics. The training for team members after the original core group was sporadic, with the opportunity for Technician Level Training occurring only when it met one criterion---that it be cost-free to the Department. The program was supported on a Spartan budget of $2,000 to $5,000 yearly which provided only for equipment and supplies with no money for outside training. When the program was

established, it had little administrative support. In 1987, a Hazardous Materials Coordinator was appointed to lead the program. The Coordinator had very little administrative support and soon left the position. The Hazardous Materials Coordinator position was added as an additional duty for the Omaha Fire Department Training Chief. The program was a secondary priority for the Training Chief, who had little time and a very small budget with which to try to improve the program. In 1994, after an extensive Fire Department study, a full-time Hazardous Materials Coordinator (a fire captain), was put in charge of the program. In 1995, a Chief Officer was put in charge of the program, and with the implementation of the additional duties now assigned to the team, the program began to receive both a higher priority and higher funding. Despite these enhancements of the Hazardous Materials program, Hazardous Materials Training has remained an unfunded priority. The Omaha Fire Department does Hazardous Materials Awareness and Operations Programs for all their firefighters, and since 1994 all recruit classes receive that training in the Omaha Fire Department Training Academy. The higher levels of Hazardous Materials training (Hazardous Materials Technician, Specialist, and Incident Commander) are still only available when a free program or outside funding becomes available. With this system, we have managed to train approximately thirty-five people to the Technician Level; some of these individuals have Specialist training, and only four people have Incident Commander qualifications.

The training level of our Hazardous Materials Technicians is a large question mark. Some receive excellent training in 80- to 120-hour courses while others receive a minimal 32- to 40-hour courses with no hands-on training. The Omaha Fire Department has no training requirements for Hazardous Materials Technicians, with the exception of

a certificate of participation in a Technician Level Course which is a requisite to being assigned to the Hazardous Materials Team. The Program also does not have any continuing education requirements, and the in-house training is non-existent. The in-house training program is nothing more than a paper trail, with little or no training involved.

The program suffers from a negative self-image. The Fire Department members see the program as second-class and have no confidence in the program or the team when they respond to an emergency. The Omaha Fire Department has a transfer policy that allows firefighters to transfer at three-month intervals on a seniority-bidding basis. Omaha Fire Department personnel with less than three years of seniority have no rights of transfer. The Hazardous Materials Program is a volunteer program. The program has suffered since its inception with not enough volunteers to fill the openings on the Hazardous Materials Unit. The department has tried a number of tactics to induce firefighters to volunteer (i.e.: $100 specialty pay per month, specialty uniforms, and increased overtime), but nothing has changed the negative organizational culture of the Omaha Fire Department members towards the Hazardous Materials Team. A transfer to the Hazardous Materials Unit is seen as a punishment and a bad duty assignment. The volunteer program, combined with the Omaha Fire Department's transfer policy, has made it difficult for the program to attract good leaders. Without good leaders and long-term commitments to the program, the program will be destined to mediocrity and will have no chance of success.

The program is at a crossroads in its development due to the increased cooperation between the Hazardous Materials Coordinator and the new Battalion Chief

in charge of the Omaha Fire Department Training Academy. There is a consensus that: the training requirements be increased, and a new mandatory training schedule with quality control be developed and instituted. With the implementation of the recommendations of this project, we look forward to the program's improvement and resultant growth.

The project is being done as a requirement for the "Executive Development" course for the National Fire Academy Executive Fire Officer Program. This project's recommendations will be to improve the training requirements and the organizational culture of the Omaha Fire Department with respect to the Hazardous Materials Program.

LITERATURE REVIEW

The literature review for this paper was accomplished by examining documents from Federal regulations and the National Fire Protection Association standards regarding hazardous materials response to emergency incidents. The Occupational Safety and Health Administration (OSHA) establishes training requirements for hazardous material responders (OSHA CFR 1910.120). The National Fire Protection Association (NFPA) provides recommended practices for responding to hazardous materials incidents and professional competencies for firefighters involved in hazardous materials response (NFPA 471, 1997), (NFPA 472, 1997). The above references helped to answer the first question posed by this paper:

1. What are acceptable training standards for fire department hazardous materials response team members at a technician level?

The Federal Government sets specific minimum legal standards for Hazardous Materials Technicians (OSHA CFR 1910.120). *OSHA CFR 1910.120* defines a Hazardous Materials Technician as an individual who responds to releases or potential releases for the purpose of stopping the release. The Hazardous Materials Technicians are expected to assume a more aggressive role than a first responder at a Hazardous Materials awareness or operations level. The Hazardous Materials Technician will take an offensive tactic. They will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

The base competency skills for Hazardous Materials Technicians must include the following:

- A minimum of 24 hours of training to the First Responder level.
- Know how to implement the employer's emergency plan.
- Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.
- Know how to use and select proper specialized chemical protective equipment and clothing.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement the decontamination procedures.
- Understand termination procedures.

- Understand basic chemical and toxicological terminology and behavior (OSHA CFR 1910.120).

The requirements set by OSHA are minimum requirements that are open to interpretations. Some trainers provide this training in 32 hours (Safety and Health Council of Greater Omaha) and some in 80 to 240 hours (Association of American Railroads, Hazardous Materials Training Center). Because of this lack of specific direction, the National Fire Protection Association set forth guidelines for training firefighters who respond to hazardous materials incidents at all levels: Awareness, Operations, Technicians, Specialists, Incident Commanders and Safety Officers (NFPA 472, 1997). The National Fire Protection Association also has provided specific information on the practices for responding to hazardous materials (NFPA 471, 1997). The competencies required by the National Fire Protection Association are very specific as compared to the Occupational Safety and Health Administration Guidelines. The three main goals in NFPA 3, Chapter 4, "Competencies for Hazardous Materials Technicians" are:

1. Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes.
2. Plan a response within the capabilities of available personnel, personal protective equipment and control equipment.
3. Implement planned response to favorably change the outcomes consistent with the organization's standard operating procedures and safety considerations.

Each of these main goals is achieved by doing a series of tasks. Example: Goal #1. Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

Task #1 – Survey the hazardous materials incident to: identify special containers involved, identify or classify unknown materials, and to verify the presence and concentrations of hazardous materials through the use of monitoring equipment. This task is further broken down into example categories. In NFPA 472 4.2.1.1.1, given examples of the following railroad cars, identify each car by type and identify at least one material and its hazard class that is typically found in each car:

(a) Cryogen liquid tank cars

(b) High pressure tube cars

(c) Non-pressure tank cars

(d) Pneumatically unloaded hopper cars

(e) Pressure tank cars

(NFPA 472, 1997).

The entire chapter is essentially a training outline for Hazardous Materials Technicians. The National Fire Protection Association also provides in NFPA 471 a breakdown of the practices for responding to a hazardous materials incident. It covers:

- Administration
- Incident response planning
- Response levels
- Site safety
- Personal protective equipment

- Incident mitigation
- Decontamination
- Medical monitoring

National Fire Protection Association Standard 471 provides excellent material for reference and other publications. This standard is outlined and could easily be used as a training guideline.

The National Fire Protection Association gives fire departments excellent training standards, and OSHA CFR 1910.120 takes the final step in requiring annual refresher training for all hazardous materials responders. Refresher training should include:

1. Competency re-testing for all response skills.
2. Technical information updates.
3. Critique of incident scene decision-making using simulated emergencies (Hazardous Materials Emergency Preparedness, HMEP, December 30, 1998).

The training and education methodology of the hazardous materials responders requires considerations and recommendations. Training is best conducted with a combination of classroom instruction (using traditional lectures and small-group activities), field exercises involving group practice in simulated emergencies, and hands-on skill training in doing actual control, confinement, and containment exercises. In the lecture class, a student to trainer ratio of 30:1 is reasonable and a 10:1 ratio is appropriate for hands-on skills. There should be a strong emphasis on hands-on practice and incident decision-making activities requiring analyses of incident information to determine plans of action. Skill training with simulated releases on actual

containers, including the use of full protective equipment and proper response tools, is extremely vital to quality hazardous materials training (Hazardous Materials Emergency Preparedness, HMEP, 1998).

2. What can be done to mandate training requirements for the Omaha Fire Department's Hazardous Materials Technicians?

For training requirements to be established, the Omaha Fire Department must show a strong commitment to the hazardous materials program. Since the program's inception in 1985, the Omaha Fire Department has made a significant financial commitment to the program. (Scalise/Nichols/Wesson, 1995). The Department's commitment to the program grew significantly in 1995 when the Hazardous Materials Unit became a dedicated response unit led by a Battalion Chief assigned as a Hazardous Materials Coordinator. Each shift is staffed by one full-time captain, one fire apparatus engineer, and two firefighters (City of Omaha Ordinance No. 34645, 1998-2001). The department has also increased the responsibilities of the team with the addition of the collateral responsibilities of the Confined-Space Rescue and High-Angle Rescue programs.(GO HAZ-MAT 96-02, 1996). With the introduction of the Rapid Intervention Team responsibilities in 1997, four Cairns thermal imaging helmets were subsequently added to the Hazardous Materials Unit. The Department's commitment to the full-time Hazardous Materials Unit has been solidified with these collateral duties. These collateral duties have added to the workload and responsibilities of the team, but have not addressed the lack of Hazardous Materials training at the Technician level.

With these additional duties, the department mandated that the individuals assigned to Engine Company #33 be Hazardous Materials Technicians and be cross-

trained in all the Hazardous Materials Team's responsibilities (GO HAZ-MAT 96-01, 1996).

The Hazardous Materials budget has also grown with the expanded role of the team:

BUDGET

	Equipment/Supply	Training
1998	$19,500	$8,500
1999	$21,700	$5,000
2000	$19,800	$5,000

The Omaha Fire Department has shown a strong and growing commitment to the program, but that commitment has not been directed at training. The yearly equipment and supply budget has grown from an insignificant $5,000 to a much larger equipment/supply budget. Training money, however, remains earmarked for confined space training only. There remains no money for hazardous materials response training (Omaha Fire Department Budget: 1998, 1999, 2000).

The Omaha Fire Department's Standard Operating Procedures does not address training requirements, guidelines or standards (OFD SOP, Haz-Mat 1-1-1 1992).

A review of two training programs was conducted for this project to determine if quality hazardous materials programs were available and could be duplicated. The Department of Defense (DOD) Firefighters Certification Systems Hazardous Materials Training and Certification Program provides a comprehensive hazardous materials

training, testing, and certification program for the United States Air Force firefighting personnel. The program includes all the components of OSHA CFR 1910.120 and NFPA 472 and the program offers a Train-the-Trainer Course. The Department of Defense program is certified by the International Fire Service Accreditation Congress (IFSAC) operated by Oklahoma State University (U.S. Air Force DoD, 1998).

The Hazardous Materials Training at the Association of American Railroads Transportation Technology Center is a training facility located in Pueblo, Colorado, that offers a full range of hazardous materials classes. All these classes meet and/or exceed the OSHA and NFPA requirements. The programs at the Transportation Center offer a good mix (50/50) between classroom lecture and hands-on training at the best hands-on facility in the country. The exemplary program at the Transportation Center demonstrates how a thorough field training program can produce quality technicians (Transportation Technology Center, 1999).

These programs provided both excellent classroom and field training, and with time and financial support, could be duplicated and used by the Omaha Fire Department Hazardous Materials Program.

3. What strategies can be employed to build team unity and excellence on the Omaha Fire Department Hazardous Materials Response Team?

For the Omaha Fire Department to begin to build an excellent Hazardous Materials Response Team, we must be able to choose the right members. All too often, people are chosen as a team member for the wrong reasons. Selecting people who are best equipped to achieve the team's objectives should be the paramount goal (Larson/LaFasto, 1989). The Omaha Fire Department's Firefighters, Captains and

Battalion Chiefs work under a comprehensive labor agreement. *Article 35, Section 6* of the contract between the City of Omaha and the Professional Firefighters Association of Omaha, (Local 385), states that fire administration has the right to make administrative transfers to meet the needs of the department. *Article 35, Section 7* of the same document states that fire administration shall have the exclusive right of assignment for an employee's first three years of service. *Article 35, Section 6* and *7* in this agreement gives fire management the ability to select the people who will make up our Hazardous Materials Team and to select qualified team members (City of Omaha Ordinance No. 34645, 1998-2000). The members of this team must possess the necessary technical skills and abilities to achieve the desired objectives of the new Hazardous Materials Program and have the characteristics required to achieve excellence while working with others (Larson/LaFasto, 1989). Fire administration must agree to a selection criteria based on technical skills and characteristics that will ensure our new Hazardous Materials Team members work well as a team. Within this selection process, we must also realize the importance of finding excellent leaders for our team. Leadership is difficult to define, but even without a definition, we can all recognize it. It should not be our intention to go on a hunt to find "born leaders" but to find individuals who have the capacity to learn to be leaders (Fire Eng., Feb 1999). With a selection criteria and the ability to efficaciously staff the team, the OFD can select the firefighters and officers who will build pride and excellence into the new Hazardous Materials Team.

To take these selected groups of individuals and create a cohesive team will take hard work and a set of team-building skills. To build a dynamic team, the new

Hazardous Materials Team members, led by a qualified and motivated officer, must be able to:

- Clearly state their mission and goals
- Operate creatively
- Focus on results
- Clarify roles and responsibilities
- Be organized
- Build upon individual strengths
- Support leadership and each other
- Develop a team climate
- Resolve disagreements
- Communicate openly
- Make objective decisions
- Evaluate their own effectiveness

(Chang, 1994).

The Omaha Fire Department's managers will have to embrace this new team strategy and empower the members of the Hazardous Material Team. This new team must be empowered to manage themselves in pursuit of their organizational team goal (Carr, 1992). Self-management is a new concept for most fire departments. It breaks with the traditional para-military rank system. The concept is for empowered teams to work within the rank structure. These self-managed teams will create more control and discipline at an emergency incident than the typical fire company (Carr, 1992).

Teamwork can no longer be an option. It is essential for growth. We are tasked with providing our customer/citizens with the best, most efficient emergency response we are able to provide. With this newly conceptualized team-building, we can be enhance our effectiveness and provide that service excellence (Romig, 1996).

4. Can the organizational culture of the Omaha Fire Department be changed to accept the Hazardous Materials Team as an elite unit?

The organizational culture of the Omaha Fire Department views our current Hazardous Materials Program as a necessary evil, a program that offers little and demands little. This negative overall view of the program does have a predecessor---- the Omaha Fire Department's Emergency Medical Services (EMS) Program, which was started in 1946 as a patient-hauling service. Over the next 30 years, the EMS program grew incrementally, initially offering basic first aid and transportation and increasing their scope of medical services to include basic life support services. Unfortunately, however, being assigned to these rescue units was looked upon as a bad assignment, with newly promoted captains being forced to spend two years on these rescue squads. In 1976, the first paramedic class began, and by 1979 the Omaha Fire Department's EMS responders were paramedics providing advanced life support services. In the last twenty years, the EMS program has been on the cutting edge of EMS fire-based response and is a leader in the field. The program is currently highly esteemed both locally and nationally; what initially was considered to be an undesirable program now enjoys the favor of the members of the Omaha Fire Department and the citizens of Omaha, Nebraska (Scalise/Nichols/Wesson, 1993).

This change in the organizational culture took forty years. Department-wide educational training on organizational culture and how it is changed will be the beginning of a self- examination which will eventually lead to some positive changes in our fire department's view of itself and the new Hazardous Materials Team (Griffiths, 1995).

We must be cognizant of our organizational culture and its effects so we can begin to influence changes (Griffiths, 1995). If our new Hazardous Materials Unit excels as a team and proves its competence at emergency scenes and company training exercises, it will begin to earn the respect of the Omaha Fire Department members. With this respect and an effort to define our actual and desirable organizational culture as a fire department, this culture for our new Hazardous Materials Team should improve and will be used as a starting point to improve the overall organizational culture of the fire department.

PROCEDURES

The Omaha Fire Department's Hazardous Materials Response Program does not have any training standards, and the program suffers from a negative image within the department. This project attempts to offer solutions for both of these problems.

The first step in this project was to identify training standards for the Department's Hazardous Material Technicians. The next step in the project was to examine the Omaha Fire Department's Standard Operating Procedures and budget to determine if the department could meet a comprehensive training requirement.

The third step of the project was to determine if the Omaha Fire Department's current contractual obligations and Standard Operating Procedures would allow Fire Management to staff the Hazardous Materials Unit with qualified personnel. The final step in the procedural process was to identify strategies for creating a standard of excellence within the Hazardous Materials Program.

Definitions

Hazardous Materials Technician: "A person who responds to releases or potential releases of hazardous materials for the purpose of controlling the release. Hazardous Material Technicians are expected to use specialized chemical protective clothing and specialized control equipment." (NFPA 472, 1997).

Hazardous Material: "A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property." (NFPA 472, 1997).

Excellence: "very great merit, quality or ability" (Webster's Dictionary of the English Language, 1989).

Organizational Culture: "The assumptions (values and beliefs) that leaders, founders, and employees bring with them to the organization and the actual experience(s) of people within the organization adapting to the internal and external environment." (Executive Development, 1999).

Dedicated Hazardous Materials Unit: The Hazardous Materials Unit will be staffed full time with a complement of four individuals: a Captain, a Fire Apparatus Engineer, and two Firefighters trained to the Hazardous Materials Technician Level.

Hot Zone: "The area of maximum hazard and is restricted to essential personnel wearing the proper protective clothing and having a specific activity." (Omaha Fire Department Standard Operating Procedure, 1986).

Warm Zone: "The area that surrounds the hot zone and is also restricted. The level of personal protection required will be less than that of the hot zone. The decontamination line is in the warm zone." (Omaha Fire Department Standard Operating Procedure, March 1986).

Research Methodology

Descriptive and action research techniques were used to conduct this research project. Research was conducted at: the Learning Center at the National Fire Academy, the University of Nebraska at Omaha Library, the Internet, and the City of Omaha Fire Department's Budget and Standard Operating Procedures.

Assumptions and Limitations

The limitations and assumptions that affected this research project included reference material availability, hazardous materials training program reviews, and an assumption about the state of the Omaha Fire Department's Hazardous Materials Program.

The reference material available for looking at team dynamics in fire department small groups was limited.

Finding a model with which to review existing (comprehensive) hazardous materials programs to meet the Omaha Fire Department's training needs was limited due to time constraints. The two programs were reviewed by examining their content and by questioning individuals who have completed the two programs. This process was very time-intensive.

The assumption that the Omaha Fire Department Hazardous Materials Team suffers from a negative image was based on the program's history and interviews with ten of my peers. In addition, my own personal experience acting in the following capacities has led me to this assumption: the Hazardous Materials Coordinator, former Team member, suppression Battalion Chief responding with the Hazardous Materials Team and as the Chief of Training reviewing the Hazardous Materials Training records. The assumption was not based on a broad-based survey, but rather on this aforementioned information.

RESULTS

The Literature Review looked at research/reference materials for each research question.

1. What are acceptable training standards for fire department hazardous materials response team members at a technician level?

The Federal Government has established minimum training guidelines for hazardous materials responders that must be met in order to operate legally under OSHA CFR 1910.120. These OSHA guidelines are general in their approach.

The National Fire Protection Association has expanded on OSHA's guidelines and has outlined very specific requirements for Hazardous Materials Technicians in NFPA 472. This guide sets forth specific competencies that must be met in order to be considered a Hazardous Materials Technician. The National Fire Protection Association also provides a guide, (NFPA 471), for specific practices and protocols that all technicians should follow while responding to hazardous materials incidents. These recommended practices are minimum requirements that must be followed by any individual who could become an integral part of the Incident Command structure while responding to a Hazardous Materials incident. See Appendix 1 for mandated training requirements.

2. What can be done to mandate training requirements for the Omaha Fire Department's Hazardous Materials Technicians?

The Omaha Fire Department has shown a continued commitment to their Hazardous Materials Program by purchasing new equipment (a new Hazardous Materials Unit) and increasing the responsibilities of the Hazardous Materials Team. An effort must now be placed on a commitment to continued and improved training. The Hazardous Materials budget has increased, and dollars have been added for Confined-Space Training. A training program that meets the requirements of OSHA 1910.120 and NFPA 472 needs to be adopted, which would subsequently prompt the creation of a newly revised Hazardous Materials Response Standard Operating Procedures. The availability of excellent programs to use as a guide for developing a program for the Omaha Fire Department do exist and can be easily accessed and implemented. It is incumbent upon the senior management of the Omaha Fire Department to secure increased funding for hazardous materials training in order to insure the viability of the Hazardous Materials program.

3. What strategies can be employed to build team unity and excellence?

The contractual agreements between the City of Omaha and Omaha Fire Department Local 385 (representing the Omaha Fire Department's Battalion Chiefs, Captains and Firefighters) allow fire management to select and staff the new Hazardous Materials Team.

Selection criteria for inclusion on the Hazardous Materials Team would include: (a) the knowledge of and/or ability to learn technical skills for hazardous materials and special operations response; (b) interpersonal skills requisite to achieving excellence while working on a team. Officers to lead the new Hazardous Materials Team could also

be selected with the aforementioned criteria with an emphasis based on leadership skills and the ability to learn to lead. Once the new Team has been selected, the Omaha Fire Department can focus its training on meeting the newly mandated training requirements and begin the process of building a dynamic team through the use of a step-by-step team-building program.

The new Hazardous Materials Team must be unencumbered by the rigid para-military structure and be empowered to pursue their organization/team goals.

4. Can the organizational culture of the Omaha Fire Department be changed to accept the Hazardous Materials Team as an elite unit?

The Emergency Medical Services system within the Omaha Fire Department developed over a fifty-year timetable. It has been during the last ten years that the Emergency Medical Services Program has lost its negative image in the Department's organizational culture. The key to this change was the advanced training and education required of all EMS personnel by the state of Nebraska and the strict standard of care imposed by state laws and certification agencies. A new Hazardous Materials Program with a high standard of training should begin to change the attitudes of the firefighters as they respond in the field and demonstrate their effectiveness. Certification that requires continuing education, training, and skill development will ensure that team members maintain their readiness. Working as a dynamic team, the quality of their work should be evident at emergency scenes, and their success in meeting training standards and team goals should spread quickly within the Department's unofficial information passing network (gossip).

An emphasis on job-wide training is needed to identify the department's organizational culture and to accomplish its remediation. Discerning where change is needed and how it can be accomplished will help Omaha Firefighters to accurately assess the Department.

Through a pro-active approach in identifying the Department's organizational culture, an emphasis on excellence through team-building skills, and better training for our Hazardous Materials Team, the negative view of the Hazardous Materials Team will be transformed into a positive image, with volunteer service on the Team viewed as a career enhancement.

DISCUSSION

The research encountered on this subject provides a consensus on requirements for hazardous materials technician training. OSHA 1910.120 lays the groundwork for the requirements and NFPA 471 and 472 provide the specific competencies. OSHA also requires that the employer shall certify individuals trained in hazardous materials. These individuals must demonstrate competency in the skills defined by OSHA CFR 1910.120 (HMEP, 1998). The National Fire Protection Association Standards are also approved as the American National Standard, and although the NFPA Standards are only suggested standards, many fire departments and municipalities adopt NFPA Standards for their legal standards (NFPA 472, 1997).

These two documents provide a clear directive for fire departments to follow for minimum training guidelines.

The research that concentrated on what the Omaha Fire Department could do to mandate requirements found that the Department does have an on-going commitment to the Hazardous Materials Response Program. In 1995, Fire Chief Don Brunken saw a need for a Hazardous Materials Response Team and began the development of such a program (Scalise/Nichols/Wesson, 1993).

The Omaha Fire Department Standard Operating Procedures for Hazardous Materials Response outlines the Department's commitment to hazardous-materials response. The Hazardous Materials Emergency Response Unit was activated in response to a recognized need for specially trained personnel with proper equipment to handle emergency incidents involving hazardous materials. Any release of a hazardous material can pose a threat to life, property, and the environment. It is the goal of the Omaha Fire Department to react correctly when a hazardous materials release occurs and handle the incident in the most efficient manner, keeping as paramount the safety of citizens and firefighters. The Omaha Fire Department Incident Commander will be in charge of and responsible for the areas which are designated as hot and warm zones of any declared hazardous materials incident (Omaha Fire Department, Standard Operating Procedure, 1992).

The Department of Defense Hazardous Materials Program is an ideal model for the Omaha Fire Department to follow. The program is set up on CD rom disks with full Power Point capabilities and an interactive review and recertification program for individual members to use on a self-study basis (U.S. Air Force DoD, 1998).

The question that remains unanswered is whether or not Omaha Fire Department's senior management will successfully secure funding for the new

program. New training requirements can be mandated and become Standard Operating Procedures, but without proper funding, it will be difficult to develop the programs to support the training mandate.

The research involved in this paper indicated that exemplary teamwork programs with the right team members can change an organization and its productivity. Teams have an extra spark and energy! They have *esprit de corps* and an "all for one and one for all" attitude. Trust is high among team members. Many people are confused and think that trust, enthusiasm, and cohesiveness cause good teamwork. *Esprit de corps* and trust are, in fact, the effects of teamwork (Romig, 1996). Teamwork creates excellence, the one concept that everyone can understand and appreciate. If the goal is clear, worthwhile, and challenging, team members will probably do a better job energizing and commanding themselves and fellow team members than will sources above or outside the team (Larson/LaFasto, 1989).

Within these teams, there must be good leadership. The research has indicated that we don't have to wait for a "born leader," we can teach individuals to be leaders. These leaders must be able to question the status quo and have the courage to change the way we currently do business. The new leaders of the Hazardous Materials Program must be able to change the values and habits of the individuals in the Program in order to build the Program (Fire Eng., Jan. 2000). Effective leadership does, in fact, fundamentally change what the team effort is all about. Leaders make people feel connected with the mainstream of what is happening by helping them understand the organization's vision. By overcoming inertia, they demonstrate that change is possible. Perhaps most importantly, they create self-confidence in people, thereby encouraging

them to take risks, make decisions, and act, – in short, to be leaders themselves (Larson/LaFasto, 1989). A program that teaches team-building skills and moves the team along in a step-by-step process can help build and create a hazardous materials program with team unity and excellence. Teamwork applied in a haphazard way, a way that is not well directed and focused, will not create the dynamic team the Omaha Fire Department needs to develop.

Lastly, the research showed that organizational cultures can be changed. For the Omaha Fire Department to change its organizational culture, it must take a pro-active approach. It must understand resistance to change, modify socialization tactics and find, cultivate and reward innovative leadership (Changing Organizational Culture, 1999). The organization's cultural changes are brought about by organizational restructuring and by the leaders of the organization articulating the direction in which they want to go. Cultural change must expand through communication, and early successes must be publicized. The leaders must personally practice the desired behavior and serve as role models for the new culture (Mohsen Attarau, 1998).

The organizational culture of the Omaha Fire Department Hazardous Materials Team can be changed with the approach outlined in this project.

The implications of this project's findings for the Omaha Fire Department could revolutionize and energize the Omaha Fire Department Hazardous Materials Program. A comprehensive training requirement and continued training emphasized within the structure of a new team-based program would create a model Hazardous Materials Program that could serve as an example for the rest of the Omaha Fire Department. Its

final and inevitable result would be a Hazardous Materials Program that was respected and had a waiting list of qualified volunteers.

Without implementing the recommendations of this project, the Omaha Fire Department Hazardous Materials Program will remain stagnant, and the turnover of personnel will continue to be high. The ultimate price of a human life will someday be paid due to the lack of training and the lack of comprehensive training requirements.

RECOMMENDATIONS

This research supports the following recommendations for the Omaha Fire Department:

- Adopt minimum training standards for Hazardous Materials Technicians based on the requirements of OSHA CFR 1910.120 and NFPA 472.
- Adopt NFPA 471 as a training standard for all officers who are Hazardous Materials Technicians.
- Develop an in-house technician program, modeled after the Department of Defense Firefighter Certification System's Hazardous Materials Training and Certification Program.
- Adopt a criteria based on technical competencies in hazardous materials response and characteristics required for working in a team environment.
- Select new Hazardous Materials Team members.
- Develop or adopt a credible team-building program for the Hazardous Materials Team.

- Re-write the Hazardous Materials Standard Operating Procedures to include training requirements and team-building strategies.
- Implement a department-wide review and training on organizational culture.
- Dedicate and fund a line-item budget for hazardous materials training, both in-house and outside of the Omaha Fire Department.
- Monitor the new Hazardous Materials Team's team-building progress and potential with regard to modeling the Team's success Department-wide.

REFERENCES

Attarau, M. (1998, April 2). How Organizational Culture is Changed. Available http://www.csubak.edu/opa/extend/tquin/intro/notechap-6tsld009.htm.

Buckman, J. (2000, January). One-Minute Motivator. Fire Engineering, 153 (1) pp. 115-117.

Carr, C. (1992). Team Power. Englewood Cliffs, NJ: Prentice-Hall.

Chang, R.Y. (1994). Building a Dynamic Team. Irvine, CA: Chang Associates.

City of Omaha, Omaha Fire Department Budget (1998-2000). Hazardous Material section. City of Omaha Finance, Omaha, NE.

City of Omaha, Ordinance No. 34645 (1998-2001). Collective bargaining agreement between the City of Omaha and the Professional Firefighter's Association of Omaha, Local No. 385, International Association of Firefighters, AFL-CIO-CLC. (Article 35, Section 6.7). Omaha, NE: Author.

Ditomaso, N. (1999). Changing Organizational Culture. Available http://www.rutgers.edu/accounting/naw/faculty/ditomaso/ob9-4.htm

Federal Emergency Management Agency (1998, December 30). Hazardous Materials Incident Response Training Guidelines. Available http://www.fema.gov/emi/hmep

Griffiths, M. (1995). Activities for Public Sector Training. Hampshire, England: Gower.

Larson, C.E. & LaFasto, F.M. (1989). Teamwork: What Must Go Right, What Can Go Wrong. Beverly Hills, CA: SAGE.

National Fire Academy (1998). Executive Development [Student Manual]. Emmitsburg, MD: Author.

National Fire Protection Association (1997). NFPA 471: *Recommended Practice for Responding to Hazardous Materials Incidents.* Quincy, MA: Author.

National Fire Protection Association (1997). NFPA 472: *Professional Competence of Responders to Hazardous Material Incidents.* Quincy, MA: Author.

Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, 29 C.F.R. 1910.120 (H) (1989). U.S. Government Printing Office, Washington, D.C.

Omaha Fire Department, General Order (July 1996) Haz-Mat 96-01, Haz-Mat Response. Omaha, NE: Author.

Omaha Fire Department, General Order (July 1996) Haz-Mat 96-02, Confined Space Rescue. Omaha, NE: Author.

Omaha Fire Department, General Order (June 1997) Haz-Mat 97-01, Cairns IRIS Helmets. Omaha, NE: Author.

Omaha Fire Department, Standard Operating Procedure (1992). Hazardous Materials Procedures and Information. City of Omaha Printing Office. Omaha, NE: Author.

Romig, D.A. (1996) Break-Through Teamwork. Chicago: Irwin.

Scalise, L.M., Nichols, D.L. & Wesson, C.W. (1995). Omaha Fire Department 1860-1993. Dallas, TX: Taylor.

Staley, M.F. (1999, February). Learning to Become a Born Leader. Fire Engineering, 152 (2), pp 95-97.

Transportation Technology Center Emergency Response Training Center (1999). Hazardous Materials Technician [Brochure]. Pueblo, CO: Author.

United States Air Force, Department of Defense Firefighter Certification System's Hazardous Materials Training and Certification Program. (1998) CDC 47203, Hazardous Materials Technicians. (Supplement 1), Tyndall, FL: Aurthor

Webster's Dictionary, the New Lexicon of the English Language (1989). New York: Lexicon.

APPENDIX

Baseline training requirements for Omaha Fire Department Technicians will include:

A. Technicians shall have Awareness Training and Operations Training (for a minimum of 24 hours).

B. Technicians shall meet the following OSHA CFR 1910.120 requirements:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.
- Know how to select and use proper specialized chemical personal protective equipment provided to the Hazardous Materials Technician.
- Understand hazard- and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

C. Technicians shall meet the following NFPA 72 training requirements:

- NFPA 4-1.3 – Given a hazardous materials incident scenario, demonstrate an understanding of the role of Hazardous Materials Technician.

- NFPA 4-1.3(a) – Describe the responsibility to analyze the hazardous materials incident and determine the magnitude of the problem in terms of outcomes.
- NFPA 4-1.3(a)1 – Identify the responsibility to survey the hazardous materials incident to identify special containers involved, to identify or classify unknown materials, and to verify the presence and concentrations of hazardous materials through the use of monitoring equipment.
- NFPA 4-1.3.(a)2 – Identify the responsibility to collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment.
- NFPA 4-1.3(a)3 – Identify the responsibility to determine the extent of damage to containers.
- NFPA 4-1.3(a) 4 – Identify the responsibility to predict the likely behavior of released materials and their containers when multiple materials are involved.
- NFPA 4-1.3(a)5 – Identify the responsibility to estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this field.
- NFPA 4-1.3(b) – Describe the responsibility to plan a response within the capabilities of available personnel, personal protective equipment, and control equipment.

- NFPA 4-1.3(b)1 – Identify the response objectives for hazardous materials incidents.
- NFPA 4-1.3(b)2 – Identify the potential action options available by response objective.
- NFPA 4-1.3(b)3 – Identify the responsibility to select the personal protective equipment required for a given action option.
- NFPA 4-1.3(b)4 – Identify the responsibility to select the appropriate decontamination procedures.
- NFPA 4-1(b)5 – Identify the responsibility to develop a plan of action, including safety considerations, consistent with the local emergency response plan and the organization's standard operating procedures, and within the capability of the available personnel, personal protective equipment, and control equipment.
- NFPA 4-1.3(c) – Describe the responsibility to implement the planned response to favorably change the outcomes consistent with the organization's standard operating procedures and safety considerations.
- NFPA 4-1.3(c)1 – Identify the responsibility to perform the duties of an assigned hazardous materials branch position within the local incident management system (IMS).
- NFPA 4-1.3(c)2 – Identify the responsibility to don, work in, and doff appropriate personal protective clothing, including, but not limited to,

both liquid splash- and vapor-protective clothing with appropriate respiratory protection.

- NFPA 4-1.3(c)3 – Identify the responsibility to perform the control functions identified in the plan of action.
- NFPA 4-1.3(d) – Describe the responsibility to evaluate the progress of the planned response by evaluating the effectiveness of the control functions.
- NFPA 4-1.3(e) – Describe the responsibility to terminate the incident.
- NFPA 4-1.3(e)1 – Identify the responsibility to assist in the incident debriefing.
- NFPA 4-1.3(e)2 – Identify the responsibility to assist in the incident critique.
- NFPA 4-1.3(e)3 – Identify the responsibility to provide reports and documentation of the incident.
- NFPA 4-2.1 – Identify special containers involved and, given the appropriate equipment, identify or classify unknown materials, verify the identity of the hazardous materials, and determine the concentration of hazardous materials.
- NFPA 4-2.1.1 – Given examples of various specialized containers, identify each container by name and identify the material, and its hazard class, that is typically found in the container.

- NFPA 4-2.1.1.1 – given examples of the following railroad cars, identify each car by type and identify at least one material, and its hazard class, that is typically found in each car:
    (a) Cryogenic liquid tank cars
    (b) High-pressure tube cars
    (c) Nonpressure tank cars
    (d) Pneumatically unloaded hopper cars
    (e) Pressure tank cars

- NFPA 4-2.1.1.2 – Given examples of the following intermodal tanks, identify each intermodal tank by type and identify at least one material, and its hazard class, that is typically found in each tank:
    (a) Nonpressure intermodal tanks:
        1. IM-101 (IMO Type 1 internationally) portable tank
        2. IM-102 (IMO Type 2 internationally) portable tank
    (b) Pressure intermodal tanks (DOT 51) (IMO Type 5 internationally)
    (c) Specialized intermodal tanks:
        1. Cryogenic intermodal tanks (IMO Type 7 internationally)
        2. Tube modules
- NFPA 4-2.1.1.3 – Given examples of the following cargo tanks, identify at least one material, and its hazard class, that is typically found in each tank:

(a) Dry bulk cargo tanks

(b) MC306/DOT-406 cargo tanks

(c) MC307/DOT-407 cargo tanks

(d) MC312/DOT-412 cargo tanks

(e) MC331 cargo tanks

(f) MC-338 cargo tanks

- NFPA 4-2.1.1.4 – Given examples of the following facility tanks, identify at least one material, and its hazard class, that is typically found in each tank:
  (a) Nonpressure tank
  (b) Pressure tank
- NFPA 4-2.1.1.5 – Given examples of the following non-bulk containers, identify at least one material, and its hazard class, that is typically found in each container:
  (a) Bags
  (b) Carboys
  (c) Cylinders
  (d) Drums
- NFPA 4-2.1.1.6 – For each of the following, describe a method that can be used to detect them:
  (a) Nerve agents

(b) Vesicants (blister agents)

(c) Biological agents and toxin

(d) Irritants (riot control agents)

- NFPA 4-2.1.1.7 – Given examples of the following radioactive materials packages, identify each package by type and identify at least one typical material found in each package:

  (a) Type A

  (b) Type B

- NFPA 4-2.1.2 – Given three examples of facility and transportation containers, identify the approximate capacity of each container.
- NFPA 4-2.1.2.1 – Using the markings on the container, identify the capacity (by weight and/or volume) of the following examples of transportation vehicles:

  (a) Cargo tanks

  (b) Tank cars

  (c) Tank containers

- NFPA 4-2.1.2.2 – Using the markings on the container and other available resources, identify the capacity (by weight and/or volume) of each of the following facility containers:

  (a) Nonpressure tank

  (b) Pressure tank

  (c) Cryogenic liquid tank

- NFPA 4-2.1.3 – Given at least three unknown materials, one of which is a solid, one a liquid, and one a gas, identify or classify by hazard each unknown material.
- NFPA 4-2.1.3.1 – Identify the steps in an analysis process for identifying unknown solid and liquid materials.
- NFPA 4-2.1.3.2 – Identify the steps in an analysis process for identifying an unknown atmosphere.
- NFPA 4-2.1.3.3 – Identify the type(s) of monitoring equipment, test strips, and reagents used to determine the following hazards:
    (a) Corrosivity (pH)
    (b) Flammability
    (c) Oxidation potential
    (d) Oxygen deficiency
    (e) Radioactivity
    (f) Toxic levels
- NFPA 4-2.1.3.4 – Identify the capabilities and limiting factors associated with the selection and use of the following monitoring equipment, test strips, and reagents:
    (a) Carbon monoxide meter
    (b) Colorimetric tubes
    (c) Combustible gas indicator
    (d) Oxygen meter
    (e) Passive dosimeter

(f) Photoionization detectors

(g) pH indicators and/or pH meters

(h) Radiation detection instruments

(i) Reagents

(j) Test strips

- Rad. 1st Resp. – Demonstrate how radiation detection instruments may be used defensively.
- NFPA 4-2.1.3.5 – Given three hazardous materials, one of which is a solid, one a liquid, and one a gas, and the following monitoring equipment, test strips, and reagents, select the appropriate equipment and demonstrate the proper techniques to identify and quantify the materials:

  (a) Carbon monoxide meter

  (b) Colorimetric tubes

  (c) Combustible gas indicator

  (d) Oxygen meter

  (e) pH indicators and/or pH meters

  (f) Radiation detection instruments

  (g) Reagents

  (h) Test strips

- NFPA 4-2.1.3.6 – Demonstrate the field maintenance and testing procedures for the monitoring equipment, test strips, and reagents provided by the authority having jurisdiction.
- NFPA 4-2.1.4 – Given a label for a radioactive material, identify vertical bars, contents, activity, and transport index, then describe the labeled item and its significance in surveying a radioactive materials incident.
- NFPA 4-2.2 – Given access to printed resources, technical resources, computer data bases, and monitoring equipment, collect and interpret hazard and response information not available from the current edition of the *North American Emergency Response Guidebook* or a material safety data sheet (MSDS).
- NFPA 4-2.2.1 – Identify and interpret the types of hazard and response information available from each of the following resources and explain the advantages and disadvantages of each resource:
    (a) Hazardous materials data bases
    (b) Maps and diagrams
    (c) Monitoring equipment
    (d) Reference manuals
    (e) Technical information centers (i.e., CHEMTREC/CANUTEC/ SETIQ)
    (f) Technical information specialists
- NFPA 4-2.2.2 – Describe the following terms and explain their significance in the risk assessment process: (a) Acid, caustic; (b) Air

reactivity; (c) Boiling point; (d) Catalyst; (e) Chemical interactions; (f) Chemical reactivity; (g) Compound mixture; (h) Concentration; (i) Corrosivity (pH); (j) Critical temperatures and pressure; (k) Expansion ratio; (l) Flammable (explosive) range (LEL & UEL): (m) Fire point; (n) Flash point; (o) Halogenated hydrocarbon; (p) Ignition (autoignition) temperature; (q) Inhibitor; (r) Instability; (s) Ionic & covalent compounds; (t) Maximum safe storage temperature (MSST); (u) Melting point/freezing point; (v) Miscibility; (w) Organic and inorganic; (x) Oxidation potential; (y) pH; (z) Physical state (solid, liquid, gas); (aa) Polymerization; (bb) Radioactivity; (cc) Saturated, unsaturated, and aromatic hydrocarbons; (dd) Self-accelerating decomposition temperature (SADT); (ee) Solution, slurry; (ff) Specific gravity; (gg) Strength; (hh) Sublimation; (ii) Temperature of product; (jj) Toxic products of combustion; (kk) Vapor density; (ll) Vapor pressure; (mm) Viscosity; (nn) Volatility; (oo) Water reactivity; (pp) Water solubility; (qq) Nerve agents; (rr) Vesticants (blister agents); (ss) Biological agents and toxins; and (tt) Irritants (riot control agents).

- NFPA 4-2.2.3 – Describe the heat transfer processes that occur as a result of a cryogenic liquid spill.
- NFPA 4-2.2.4 – Given five hazardous material scenarios and the appropriate reference materials, identify the signs and symptoms of exposure to each material and the target organ effects of exposure to that material.

- NFPA 4-2.2.5 – Given the scenario of a domestic gas line break and the readings from a combustible gas indicator, determine the area of evacuation.
- NFPA 4-2.2.6 – Identify two methods for determining the pressure in bulk packaging or facility containers.
- NFPA 4-2.2.7 – Identify one method for determining the amount of lading remaining in damaged bulk packaging or facility containers.
- NFPA 4-2.3 – Given simulated facility and transportation container damage, describe the damage.
- NFPA 4-2.3.1 – Given three examples of containers, DOT specification markings for nonbulk and bulk packaging, and the appropriate reference guide, identify the basic design and construction features of each container.
- NFPA 4-2.3.1.1 – Identify the basic design and construction features, including closures, of the following bulk containers:
    (a) Cargo tanks:
        1. Dry bulk cargo tanks
        2. MC-306/DOT-406 cargo tanks
        3. MC-307/DOT-407 cargo tanks
        4. MC-312/DOT-412 cargo tanks
        5. MC-331 cargo tanks
        6. MC-338 cargo tanks
    (b) Fixed facility tanks:

1. Nonpressure tank
2. Pressure tank

(c) Intermodal tanks:

1. Nonpressure intermodal tanks:
    a. IM-101 portable tank
    b. IM-102 portable tank
2. Pressure intermodal tanks (specification 51)
3. Specialized intermodal tanks:
    a. Cryogenic intermodal tanks
    b. Tube modules

(d) One-ton containers

(e) Pipelines

(f) Railroad cars:

1. Cryogenic liquid tank cars
2. High-pressure tube cars
3. Nonpressure tank cars
4. Pneumatically unloaded hopper cars
5. Pressure tank cars

(g) Intermediate bulk containers (also known as tote tanks)

- NFPA 4-2.3.1.2 – Identify the basic design and construction features including closures of the following nonbulk containers:

(a) Carboys

(b) Drums

(c) Pressurized cylinders

- NFPA 4-2.3.1.3 – Identify the basic design and construction features of the following radioactive materials containers:
  (a) Type A package
  (g) Type B package
- NFPA 4-2.3.1.6 – Demonstrate a method for collecting samples of the following:
  (a) liquid
  (b) solid
  (c) gas
- NFPA 4-2.3.2 – Describe how a liquid pipeline can carry different products.
- NFPA 4-2.3.3 – Given an example of a pipeline, identify the following:
  (a) Ownership of the line
  (b) Procedures for checking for gas migration
  (c) Procedure for shutting down the line or controlling the leak
  (d) Type of product in the line
- NFPA 4-2.3.4 – Identify the types of damage that a pressure container could incur.
- NFPA 4-2.3.5 – Given examples of tank car damage, identify the type of damage in each example by name.

- NFPA 4-2.4 – Given examples of both facility and transportation incidents involving multiple hazardous materials, predict the likely behavior of the material in each case.
- NFPA 4-2.4.1 – Identify at least three resources available that indicate the effects of mixing various hazardous materials.
- NFPA 4-2.4.2 – Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk storage facility and explain their significance in the risk assessment process:
    (a) Fire protection systems
    (b) Monitoring and detection systems
    (c) Product spillage and control (impoundment and diking)
    (d) Tank spacing
    (e) Tank venting and flaring systems
    (f) Transfer operations
- NFPA 4-2.5 – Given various facility and transportation hazardous materials incidents, estimate the likely size, shape, and concentrations associated with the release of materials involved in the incident by using computer modeling, monitoring equipment, or specialists in this field.
- NFPA 4-2.5.1 – Identify local resources for dispersion pattern prediction and modeling including computers, monitoring equipment, or specialists in the field.

- NFPA 4-2.5.2 – Given the concentrations of the released material, identify the steps for determining the extent of the hazards (e.g., physical, safety, and health) within the endangered area of a hazardous materials incident.
- NFPA 4-2.5.2.1 – Describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:
    (a) Parts per million (ppm)
    (b) Parts per billion (ppb)
    (c) Lethal dose (LD_{50})
    (d) Lethal concentrations (LC_{50})
    (e) Permissible exposure limit (PEL)
    (f) Threshold limit value time-weighted average (TLV-TWA)
    (g) Threshold limit value short-term exposure limit (TLV-STEL)
    (h) Threshold limit value ceiling (TLV-C)
    (i) Immediately dangerous to life and health value (IDLH)
- NFPA 4-2.5.2.2 – Describe the following radiological terms and explain their significance in predicting the extent of health hazards and environmental impact in a hazardous materials incident:
    (a) Types
    (b) Measurement
    (c) Protection

- NFPA 4-2.5.2.3 – Identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials incident.
- NFPA 4-2.5.3 – Identify a method for estimating the outcomes within an endangered area of a hazardous materials incident.
- NFPA 4-3.1 – Given simulated facility and transportation problems, describe the response objectives for each problem and describe the steps for determining response objectives (defensive, offensive, non-intervention) given an analysis of a hazardous materials incident.
- NFPA 4-3.2 – Given simulated facility and transportation hazardous materials incidents, identify the possible action options (defensive, offensive, and nonintervention) by response objective for each problem and identify the possible action options to accomplish a given response objective.
- NFPA 4-3.3 – Given situations with known and unknown hazardous materials, determine the appropriate personal protective equipment for the action options specified in the plan of action in each situation.
- NFPA 4-3.3.1 – Identify the four levels of personal protective equipment (EPA/NIOSH or NFPA 471) and describe the equipment for each level and the condition under which each level is used.
- NFPA 4-3.3.2 – Identify the factors to be considered in selecting the proper respiratory protection for a specified action option.

- NFPA 4-3.3.2.1 – Describe the advantages, limitations, and proper use of the following types of respiratory protection at hazardous materials incidents:
    (a) Positive pressure self-contained breathing apparatus
    (b) Positive pressure air line respirators with required escape unit
    (c) Air purifying respirators
- NFPA 4-3.3.2.2 – Identify the process for selecting the proper respiratory protection at hazardous materials incidents.
- NFPA 4-3.3.2.3 – Identify the operational components of air purifying respirators and air line respirators by name and describe their functions.
- NFPA 4-3.3.3 – Identify the factors to be considered in selecting the proper chemical-protective clothing for a specified action option.
- NFPA 4-3.3.3.1 – Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing:
    (a) Degradation
    (b) Penetration
    (c) Permeation
- NFPA 4-3.3.3.2 – Identify at least three indications of material degradation of chemical-protective clothing.

- NFPA 4-3.3.3.3 – Identify the three types of vapor-protective and splash-protective clothing and describe the advantages and disadvantages of each type.
- NFPA 4-3.3.3.4 – Identify the relative advantages and disadvantages of the following heat exchange units used for the cooling of personnel in chemical-protective clothing:
    (a) Air-cooled
    (b) Ice-cooled
    (c) Water-cooled
- NFPA 4-3.3.3.5 – Identify the process for selecting the proper protective clothing at hazardous materials incidents.
- NFPA 4-3.3.3.6 – Given three examples of various hazardous materials, determine the appropriate protective clothing construction materials for a given action option using chemical compatibility charts.
- NFPA 4-3.3.3.7 – Identify the physical and psychological stresses that can affect users of specialized protective clothing.
- NFPA 4-3.4 – Given a simulated hazardous materials incident, select an appropriate decontamination procedure and determine the equipment required to implement that procedure.
- NFPA 4-3.4.1 – Identify the advantages and limitations and describe an example where each of the following decontamination methods would be used: (a) Absorption; (b) Adsorption; (c) Chemical

degradation; (d) Dilution; (e) Disposal; (f) Evaporation; (g) Neutralization; (h) Solidification; (i) Vacuuming; and (j) Washing.

- NFPA 4-3.4.2 – Identify three sources of technical information for selecting appropriate decontamination procedures and identify how to contact those sources in an emergency.
- NFPA 4-3.5 – Given simulated hazardous materials incidents in facility and transportation settings, develop a plan of action, including safety considerations, which are consistent with the local emergency response plan and the organization's standard operating procedures and are within the capability of available personnel, personal protective equipment, and control equipment for that incident.
- NFPA 4-3.5.1 – Describe the purpose of, procedures for, equipment required, and safety precautions used with the following techniques for hazardous materials control:
    (a) Absorption
    (b) Neutralization
    (c) Overpacking
    (d) Patching
    (e) Plugging
- NFPA 4-3.5.2 – Given MC-306/DOT-406, MC-307/DOT-407, MC-312/DOT-412, MC-331, and MC-338 cargo tanks, identify the common methods for product transfer from each type of cargo tank.

- NFPA 4-3.5.3 – Given a simulated hazardous materials incident, develop the safety considerations that must be included in the plan of action.
- NFPA 4-3.5.3.1 – List and describe the safety considerations to be included.
- NFPA 4-3.5.3.2 – Identify the points that should be made in a safety briefing prior to working at the scene.
- NFPA 4-3.5.4 – Identify the atmospheric and physical safety hazards associated with hazardous materials incidents involving confined spaces.
- NFPA 4-3.5.5 – Identify the pre-entry activities to be performed.
- NFPA 4-3.5.6 – Identify the procedures, equipment, and safety precautions for collecting legal evidence at hazardous materials incidents.
- NFPA 4-4.1 – Given the local emergency response plan or organization's standard operating procedures and a simulated hazardous materials incident, demonstrate the duties of an assigned hazardous materials branch position within the local Incident Management System (IMS).
- NFPA 4-4.1.1 – Identify the role of the Hazardous Materials Technician during an incident involving hazardous materials.

- NFPA 4-4.1.2 – Identify the duties and responsibilities of the following hazardous materials branch functions within the Incident Management System:
    (a) Backup
    (b) Decontamination
    (c) Entry
    (d) Hazardous Materials Branch Management
    (e) Hazardous Materials Branch Safety
    (f) Information/research
    (g) Reconnaissance
    (h) Resources
- NFPA 4-4.1.3 – Given a simulated hazardous materials incident, demonstrate setup of the decontamination corridor as specified in the planned response.
- NFPA 4-4.1.4 – Given a simulated hazardous materials incident, demonstrate the decontamination process specified in the planned response.
- NFPA 4-4.2 – Demonstrate the ability to don, work in, and doff both liquid splash- and vapor-protective chemical-protective clothing and any other specialized personal protective equipment provided by the authority having jurisdiction, including the appropriate respiratory protection.

- NFPA 4-4.2.1 – Describe three safety procedures for personnel wearing vapor-protective clothing.
- NFPA 4-4.2.2 – Describe three emergency procedures for personnel wearing vapor-protective clothing.
- NFPA 4-4.2.3 – Identify the procedures for donning, working in, and doffing the following types of respiratory protection:
    (a) Air line respirator with required escape unit
    (b) Air purifying respirator
- NFPA 4-4.2.4 – Demonstrate donning, working in, and doffing chemical-protective clothing in addition to any other specialized protective equipment provided by the authority having jurisdiction.
- NFPA 4-4.2.5 – Demonstrate the ability to record the use, repair, and testing of chemical-protective clothing according to manufacturer's specifications and recommendations.
- NFPA 4-4.2.6 – Describe the maintenance, testing, inspection, and storage procedures for personal protective equipment provided by the authority having jurisdiction according to the manufacturer's specifications and recommendations.
- NFPA 4-4.3 – Given various simulated hazardous materials incidents involving nonbulk and bulk packaging and facility containers, select the tools, equipment, and materials for the control of hazardous materials incidents and identify the precautions for controlling releases from those packaging/containers.

- NFPA 4-4.3.1 – Given a pressure vessel, select the appropriate material or equipment and demonstrate a method(s) to contain leaks from the following locations:
    (a) Fusible metal of plug
    (b) Fusible plug threads
    (c) Side wall of cylinder
    (d) Valve blowout
    (e) Valve gland
    (f) Valve inlet threads
    (g) Valve seat
    (h) Valve stem assembly blowout
- NFPA 4-4.3.2 – Given the fittings on a pressure container, demonstrate the ability to perform the following:
    (a) Close valves that are open
    (b) Replace missing plugs
    (c) Tighten loose plugs
- NFPA 4-4.3.3 – Given a 55-gal (208-L) drum, demonstrate the ability to contain the following types of leaks using appropriate tools and materials:
    (a) Bung leak
    (b) Chime leak
    (c) Forklift puncture
    (d) Nail puncture

- NFPA 4-4.3.4 – Given a 55-gal (208-L) drum and an overpack drum, demonstrate the ability to place the 55-gal drum into the overpack drum using the following methods:
    (a) Rolling slide-in
    (b) Slide-in
    (c) Slip-over
- NFPA 4-4.3.5 – Identify the maintenance and inspection procedures for the tools and equipment provided for the control of hazardous materials releases according to the manufacturer's specifications and recommendations.
- NFPA 4-4.3.6 – Identify three considerations for assessing a leak or spill inside a confined space without entering the area.
- NFPA 4-1.3 – Identify three safety considerations for product transfer options.
- NFPA 4-4.3.8 – Given an MC-306/DOT-406 cargo tank and a dome cover clamp, demonstrate the ability to install the clamp on the dome properly.
- NFPA 4-4.3.9 – Identify the methods and precautions used when controlling a fire involving an MC-306/DOT-406 aluminum shell cargo tank.
- NFPA 4-4.3.10 – Describe at least one method for containing each of the following types of leaks in MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT-412 cargo tanks:

(a) Dome cover leak

(b) Irregular-shaped hole

(c) Puncture

(d) Split or tear

- NFPA 4-4.3.11 – Describe three product removal and transfer considerations for overturned MC-306/DOT-406, MC-307/DOT-407, MC-312/DOT-412, MC-331, and MC-338 cargo tanks.
- NFPA 4-5.1 – Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging and the plan of action, evaluate the effectiveness of any control functions identified in the plan of action.
- NFPA 4-6.1 – Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, participate in the debriefing of the incident.
- NFPA 4-6.1.1 – Describe three components of an effective debriefing.
- NFPA 4-6.1.2 – Describe the key topics of an effective debriefing.
- NFPA 4-6.1.3 – Describe when a debriefing should take place.
- NFPA 4-6.1.4 – Describe who should be involved in a debriefing.
- NFPA 4-6.2 – Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, provide operational observations of the activities that were performed in the hot and warm zones during the incident.
- NFPA 4-6.2.1 – Describe three components of an effective critique.

- NFPA 4-6.2.2 – Describe who should be involved in a critique.
- NFPA 4-6.2.3 – Describe why an effective critique is necessary after a hazardous materials incident.
- NFPA 4-6.2.4 – Describe which written documents should be prepared as a result of the critique.
- NFPA 4-6.3 – Given a simulated hazardous materials incident, complete the reporting and documentation requirements consistent with the organization's emergency response plan and standard operating procedures.
- NFPA 4-6.3.1 – Identify the reports and supporting documentation required by the local emergency response plan and the organization's standard operating procedures.
- NFPA 4-6.3.2 – Demonstrate the proper completion of the reports required by the local emergency response plan and the organization's standard operating procedures.
- NFPA 4-6.3.3 – Describe the importance of personnel exposure records.
- NFPA 4-6.3.4 – Describe the importance of debriefing records.
- NFPA 4-6.3.5 – Describe the importance of critique records.
- NFPA 4-6.3.6 – Identify the steps in keeping an activity log and exposure records.
- NFPA 4-6.3.7 – Identify the steps to be taken in compiling incident reports that meet federal, state, local, and organizational requirements.

- NFPA 4-6.3.8 – Identify the requirements for compiling hot zone entry and exit logs.
- NFPA 4-6.3.9 – Identify the requirements for compiling personal protective equipment logs.
- NFPA 4-6.3.10 – Identify the requirements for filing documents and maintaining records.

All Hazardous Materials Technicians shall show competency in the aforementioned training requirements to be certified as Hazardous Materials Technicians on the Omaha Fire Department.